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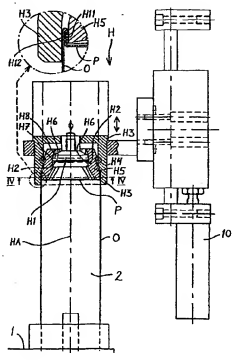
(54) Title: APPARATUS THAT CLAMPS AN END MEMBER TO A CASING

(57) Abstract

A container-forming apparatus comprising a movable mandrel (2) supporting the casing (O) and the end member (P), which closes the open end of the casing and an end sealing station (H) comprising a clamping means in order to press together the edge of the casing (O), said casing being transferred to the end sealing station (H) by the mandrel, and the edge of the end member (P), said edge being turned longitudinally towards the casing. The clamping means comprises a piston (H1) moving back and forth in the longitudinal direction of the casing, said piston having pushing surfaces (H2) approaching the sliding axle in the pushing direction causing the clamping action. The pushing surfaces are the countersurfaces (H6) of the clamping members (H5), said clamping members being arranged to turn towards the frame of the clamping means. The countersurfaces form the front portion of the piston, said front portion tapering into a V-shape in the pushing direction in order to turn the clamping surfaces (H12) of the clamping members (H5) outwards towards the clamping countersurfaces (H11) positioned on the frame (H3) of the clamping means.



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APPARATUS THAT CLAMPS AN END MEMBER TO A CASING

The object of the invention is a container-forming apparatus, which is of the type presented in the preamble of patent claim 1.

The invention particularly relates to the kind of container-forming apparatuses which produce horizontally circular cylindrical containers, in which at least one of the end members closing the container is sealed into the open end of the cylindrical casing by pressing the edges of the portions together. In practice, this is done in such a way that the end member, the outer edges of which are turned in the axial direction of the casing, is positioned inside the casing, after which the edge portion of the casing is folded double so that it is wrapped over the outwardly turned edge of the end member, after which pressure is applied in order to create the final seal. Prior to these mechanical stages the end member and the upper end of the casing are heated by air blowing, so that the heat-sealable substances on the surface of the above-mentioned portions are brought to a suitable condition.

These known container-forming stages are described, for example, in European patents 0 038 488 and 0 456 011.

The clamping means used in presently known container-forming units usually have a heavy and complex structure and, in addition, they cannot obtain sufficient clamping efficiency, which has a decisive effect on the tightness of the seal. The object of the invention is to introduce an improvement to the above-mentioned prior art and to present a container-forming apparatus, in which the clamping means is structurally easy to realise, and the said clamping means gives a good clamping effect that can advantageously be applied to the entire perimeter of the bottom portion of the casing and the end member. In order to implement this the container-forming apparatus according to the invention is mainly characterised by what is presented in the characterising part of the attached patent claim 1. The clamping means comprises a piston with a V-shaped front portion, which pushes

the clamping members radially outwards, said clamping members being pivotally mounted to turn towards the frame, whereby the folded bottom portion of the casing wrapped around the edge of the end member is pressed between the outer surfaces of the clamping members and the clamping countersurfaces positioned outermost on the frame of the clamping means. As the clamping members are mounted on bearings to turn towards the frame, said clamping members form levers, by means of which a good force effect is obtained.

Other preferred embodiments are referred to in the attached dependent patent claims and the subsequent description.

The invention is described in more detail with reference to the accompanying drawings, wherein

Figure 1 shows a longitudinal cross-section of the can forming a part of the container.

Figure 2 shows the container-forming unit in which a container-forming apparatus according to the invention is used, seen from above.

Figure 3 shows the container-forming apparatus, seen from the side.

Figure 4 shows the clamping means used in the apparatus in a cross-section along the line IV – IV.

Figure 5 shows a cross-section of another embodiment of the clamping means used in the apparatus.

Figure 6 shows the embodiment presented in Figure 5 in another position.

Figure 7 shows a certain preferable clamping position.

Figure 8 shows details of the structure of the clamping surfaces.

The following terms are used in describing the different portions of the liquid container:

container: sales package or casing depending on the context.

sales package: a finished, filled and sealed liquid container.

casing: unfilled and unsealed outer casing of the sales package.

can: a container, which is characterised by a portion, i.e. a casing, which is wrapped to form a structure that is closed in the cross-section perpendicular to the longitudinal axis, one or both ends of said casing being closed with an end member.

sidewall blank: a straight, flat member usually made of liquid packaging board, which by joining together can be formed into a casing, and which can be separated from a material having a larger area, such as a long strip.

the outer surface of the sidewall blank or the blank material: a surface that forms the outer surface of the finished container, usually bearing the printing and having a heat-sealable coating.

the inner surface of the sidewall blank or the blank material: a surface that in a finished container forms the surface which is in contact with the product to be packed, said surface usually having a heat-sealable coating.

sidewall blank material: the raw material of sidewall blanks, usually liquid packaging board covered with a heat-sealable coating.

The packaging machine comprises a container-forming unit, where the vertical

portion of the can-shaped container presented in Figure 1, i.e. casing O having a closed shape, is formed, after which the end member P closing the open end of the casing O is joined to the casing O. This can-shaped container, one end of which is still open, is transferred to the filling unit of the packaging machine where the final sales package is formed, and which is not described here in greater detail.

In the container-forming unit presented in Figure 2 there is a horizontally rotating transfer table 1, on the perimeter of which there are shaping tools at fixed angular distances, said shaping tools supporting the afore-mentioned container at different forming stages. The shaping tools are identical and each consisting of a vertical mandrel 2, around which the casing is formed, said mandrel being later referred to as the wrapping mandrel.

In addition to the transfer table 1, the container-forming unit comprises a fixed frame, on which the transfer table is arranged so as to rotate, said frame being generally designated by the reference number 10. The frame comprises processing stations, equalling the number of wrapping mandrels 2, and a certain forming stage of a can open at one end is carried out at each station. At the stop stage, during which the processing stations perform certain operations, the mandrels are positioned at the processing stations and during the transfer stage said mandrels are transferred by a short rotational movement of the table equalling in length the distance between the wrapping mandrels 2, to the following station for next processing stage.

The processing stations are now described in greater detail mainly on the basis of their function in forming a can-like casing. In every station there are parts attached to the frame 10, which by their motion or other action bring about the desired operational stages. The moving parts are positioned on the frame, mainly on the outside of the circular track of the wrapping mandrels and/or above the mandrels, or said moving parts are arranged in such a way that they are temporarily on the track of the mandrels and move out of the way for the mandrels for the duration of

the transfer stage. These different parts are not described in detail in Figure 2, which only shows the supporting structures of the various stations to which the afore-mentioned functional parts are attached.

At wrapping station A, a sidewall blank of a certain height is cut off from the lower end of the blank web, said blank web being transferred to the station with the help of transfer devices positioned on the frame, after which the sidewall blank is pushed onto the wrapping mandrel 2 and wrapped around it into a shape determined by the outer surface of the mandrel. This is how the can-like casing is formed, which in horizontal section has a closed form, in the case of cylindrical mandrels a circular form.

At sidewall sealing station B, the overlapping sidewall edges of the sidewall blank are permanently sealed together. This is performed with the help of a clamping surface, which presses the overlapping edges together and at the same time causes the cooling of the heat seal coating on the inner surface of the sidewall blank, said coating having been previously heated to a bonding temperature.

At the preheating station C, hot air is blown inside the side-sealed portion towards its top end, causing the heat seal coating on the inner surface of the sidewall blank material to heat up sufficiently.

At the end member station D, the end members, whose outlines correspond in shape to the horizontal section of the casing, are separated by die cutting from a continuous blank web M fed into the station, after which said end member is forced through a hole, causing the outer edges of the end member to bend. At the following stage the end member is pushed down onto the open upper end of the casing by using the top surface of the wrapping mandrel as a countersurface in such a way that the upward folded outer edges of the end member are pressed against the inner surface of the casing.

At the first heating station E, hot air is blown onto the outer surface of the end

member directing the air to the edges, thereby heating the lower surface of the member at the folded edge turned up towards the inner surface of the upper end of the casing.

At the other heating station F, the same process is carried out in order to ensure sufficient heating around the entire perimeter of the upper end.

At the clenching station G, the upper edge of the casing that is above the upward folded ege of the end member, is turned by pressing it from above towards the centre and down, whereby the upper edge of the casing is folded over the upward folded outer edge of the end member.

At the first end sealing station H, the edge portion of the casing is pressed against the upward folded edge of the end member, whereby the previously heated heat-seal coatings bond the members together, and the upward folded outer edge of the end member remains permanently sealed inside the U-folded upper edge.

At the second end sealing station I, the same operational stages are performed at different points than in the previous station so that the seal will be even around the entire perimeter of the already finished can-like casing.

At the last processing station, i.e. the discharge station, the can-like casing is lifted off the wrapping mandrel 2 and transferred along the conveyor track to the filling unit of the packaging machine.

When a finished can is removed from the wrapping mandrel 2, said mandrel is transferred by a short rotational movement of table 1 to the wrapping station A to receive a new sidewall blank, and the afore-mentioned processing stages are repeated.

A typical processing time at each of the stations A – J is about 500 ms including the transfer from one station to another. Consequently, the can is finished in the

container-forming unit in about five seconds, and the production capacity is one can per 0.5 seconds, i.e. about 120 cans per minute.

Figure 3 presents a container-forming apparatus according to the invention. Said apparatus comprises a wrapping mandrel 2, which is used for forming a container, said mandrel being transferred between different processing stations in the afore-described manner. The surface of the mandrel supports the casing O, which is wrapped around the mandrel to conform to the shape of said mandrel, and the end of the mandrel, being perpendicular to the casing, supports the end member P at the top, which end member is partly positioned inside the casing, the edges of said end member being folded outwards in an axial direction to the casing O towards the outer edge of said casing. Figure 3 presents a situation in which the outer edge of the casing is folded into a U-shape in such a way that the folded edge of the end member P remains inside the end fold, i.e. a can shaped like the one presented in Figure 1 is formed during this stage.

In addition, the container-forming apparatus comprises an end sealing station H, which has a clamping means that moves back and forth in an axial direction to the wrapping mandrel 2. The mandrels 2 are positioned on a supporting base plate in an upright position, such as on the afore-described transfer table 1, and the clamping means is arranged with the help of an actuator to move upwards to a position where said clamping means does not prevent the movement of the mandrels down and to operational position in such a way that the clamping means comes into contact with the end member of the can supported by the mandrel. As the previous describtion shows, the motions have to be rapid, as the processing time at different stations is less than one second.

The clamping means incorporates a piston H1, which is arranged to move by its own actuator in a longitudinal direction to the casing, i.e. in axial direction to the mandrel. On the front portion of the piston, i.e. at the end closest to the mandrel, there is a pushing surface H2 approaching in the outward pushing direction of the piston to the sliding axle HA (central axle of the piston) and the longitudinal axis of

the mandrel joining it, said pushing surface H2 being in contact with the radially outermost countersurface H6, and likewise approaching the central axle in clamping member H5. Said clamping member H5 is arranged to pivot around a transverse axle H4 against the pushing direction, whereby the outermost surface of the axle H4, seen in radial direction, forms a clamping surface H12. As the piston is pushed towards the mandrel 2, the clamping member H5 is turned outwards in the pushing direction in the area in front of the axle H4, whereby in this area the clamping surface at the end of the clamping member is moved towards the opposing, fixed clamping countersurface H11 positioned on the frame of the clamping means. The clamping member H5 and the frame of the clamping means H3 form clamping jaws, and the above-described end fold of the casing O together with the folded edge of the end member P remaining inside this fold are pressed between these clamping jaws, more accurately between clamping surface H12 and the clamping countersurface H13 1(see footnote).

Above is described the function of the clamping member H5. However, the clamping means incorporates several clamping members H5 arranged radially around the sliding axle HA, each of said clamping members having a similar structure and functioning in the same manner as that described above. All of the clamping members are therefore moved by the same piston H1, the pushing surfaces H2 of said piston forming the front portion of the piston, said front portion tapering into a V- or cone-shape in the pushing direction. Correspondingly, the clamping members H5 form an opening narrowing in a similar fashion in the pushing direction around the front portion of the piston, into which the front portion of said piston H1 fits.

Figure 3 further shows how the axles H4 of clamping members H5 are positioned in the pushing direction before the pushing surface H2 and the corresponding countersurface H6. First, the frontmost ends of the clamping members H5 are rapidly turned outwards by the force of the centrally located piston H1, i.e. said ends move rapidly to the operational position, after which the clamping force increases as the piston is pushed forward. The axes H4 are formed of the

corresponding cylindrical midlines of the axle arms. Said axle arms are positioned between the clamping members H5 and the frame H3 of the clamping means in such a way that on the outer surface of the clamping member H5 and on the inner surface of the frame H3 there is a groove curving perpendicular to the axle, which grooves together form a space into which the axle arm fits.

The clamping countersurfaces H11 on the frame H3 are arranged around the inner surface surrounding the clamping members opposite to the corresponding clamping surfaces H12 of the clamping members H5. This inner surface is naturally formed to corresponding in shape to the end of the casing, i.e. in the case of cylindrical containers it is circular. In this case the clamping surfaces are correspondingly circular in cross-section perpendicular to the pushing direction. This is shown in Figure 4, which also indicates that there are four of the clamping members H5, i.e. the clamping directions are at angles of 90(, but there may be another sufficient number of the clamping members H5. From the point of view of durability and clamping efficiency, the frame of the clamping means, the clamping members and the piston are most preferably manufactured of some metal suitable for the purpose, including alloys.

Figure 3 further shows that the piston H1 incprorates a rear portion, said rear portion tapering into a V-shape in the direction opposite to the pushing direction - i.e. in the pulling direction - and being formed by pulling surfaces H7 approaching the sliding axle in this direction. These pulling surfaces are in contact with the countersurfaces H8 of the clamping members, said countersurfaces correspondingly approaching the sliding axle. This means that the clamping surfaces H12 of the clamping members H5 can be moved away from the equivalent countersurfaces H11, i.e. the clamping jaws are opened by pulling the piston H1 backwards, whereby the end of the casing can be released from clamping and the clamping means can be moved away from the mandrel when the clamping stage is over. This is also the position of clamping members when the clamping means is again moved to the operational position into contact with the end of the casing and the end member.

The cycle of operations performed at the work station includes the following successive stages:

transfer of the clamping means with clamping jaws open into contact with the end of the casing
closing of the clamping jaws in order to press the skirt of the casing between the clamping jaws
opening of the clamping jaws
moving of the clamping means with the clamping jaws open, away from the end of the casing

Figure 5 presents a clamping means in accordance with another embodiment, the main principle of which is otherwise the same except that a balancing ring H9 is placed between the clamping members H5 and the frame H3. This balancing ring H9 can be placed in an annular space formed at the back of the clamping surfaces and the countersurfaces as seen from the pushing direction, said annular space being formed behind the shoulders, which are positioned in the inwardly radial direction in relation to of the clamping surface H12 and in the outwardly radial direction in relation to the clamping countersurface H11. Figure 5 presents an alternative structure to the above-mentioned separate ring, in which the balancing ring 9 continues as a clamping countersurface H11 fixed to the frame, in the direction of the outermost end of the clamping means, i.e. the balancing ring 9 and the clamping countersurface H11 are located in the same annular member, which is attached to the widening at the end of the frame H3.

When moving the clamping means to the operational position, the balancing ring H9 meets the upper edge of the casing, i.e. the uppermost point of the U-fold, and makes an even fold. The ring also functions as a limiter to the clamping motion. The balancing ring H9 can be made of a hard plastic material, avoiding the noise caused by moving metal parts, or of metal.

Figure 5 further shows a damper ring H10, which is positioned at the end of the clamping members H5, said ring remaining between the clamping members and the frame of the clamping means when the piston is pulled backwards. This ring functions as a limiter to the opening of the clamping members and is of certain suitable material, such as a hard plastic.

In front of the clamping countersurface H11 in the pushing direction there is a bevelled surface H13, which ensures that the axial edge of the container is directed into the annular space between the clamping countersurface H11 and the clamping surfaces H12.

Figure 6 presents a situation in which the clamping jaws, formed by the clamping members H5 and the frame H3, are opened. From this figure and the structures described above it is also evident that a short motion is alone sufficient to open the jaws and, correspondingly, to close them. This means that the clamping surfaces H12 and the clamping countersurfaces H11 are at a relatively small opening angle, between 4 and 6(, for example about 5(with respect to one another. In addition, the parts are dimensioned in such a way with respect to one another that when the piston is in its frontmost position, i.e. at maximum clamping, the aforementioned surfaces are at least parallel or form an opening angle against the pushing direction. If the surfaces are parallel, the both edges of the fold at the end of the can, said fold being of the same thickness from one end to the other, are pressed evenly against the clamping surface H12 and the clamping countersurface H11 in this position, this situation also being described in the magnified detail of Figure 3. If the extreme position exceeds this position in such a way that the clamping surface H12 is directed obliquely away from the straight clamping countersurface H11, corresponding to the outer surface of the casing O, in the direction of the piston, the fold can be clamped more at the base, thus ensuring tightness especially at the point where the outermost edge of the skirt of the casing O is folded against the end member P.This position is presented in Figure 7. In the extreme position, the surfaces can also meet each other at the edges, in which case they are kept apart at the clamping stage by the material of

the end member of the container in a position determined by the clamping force and the compressibility of the material.

Figure 8 presents in more detail the section of the clamping surfaces perpendicular to the sliding axle HA. Both surfaces H11 and H12 are axially grooved in order to get a better grip, whereby the corresponding axial surfaces of the fold of the end member are slightly crimped.

As shown in Figure 2, there can be two end sealing stations with in principle the same kind of clamping means. As separate clamping members can not clamp evenly around the entire circumference of the end seal, it is preferable to arrange the clamping members in the next end sealing station in such a way that they cover the gaps in the preceding end members on this circumference.

As the container-forming unit comprises two successive heating stations E and F, said heating stations being positioned after the pre-heating station C and the end member station D, and as the temperature of the blown air is usually at least 300(C, the heat seal coatings on the surfaces of the end member P and the casing O, said portions placed against each other, are sufficiently hot, and so the clamping surfaces of the clamping means at the end sealing stations H and I do not need to be heated, as the mechanical clamping caused by the clamping surfaces is sufficient to bring about a strong end seal. In consequence, the clamping means is of light and simple structure.

Claims

1. A container-forming apparatus comprising a movable mandrel (2) supporting the casing (O) and the end member (P), which closes the open end of the casing, and an end sealing station (H) comprising a clamping means, which presses together the edge portion of the casing (O), said casing being transferred to the end sealing station (H) by a mandrel, and the edge of the end member (P), said edge being turned longitudinally towards the casing, **characterised** in that the clamping means comprises a piston (H1), which moves back and forth in a longitudinal direction to the casing, said piston having pushing surfaces (H2) approaching the sliding axle in the pushing direction causing clamping, said pushing surfaces being the countersurfaces (H6) of clamping members (H5), said clamping members being arranged to turn towards the frame of the clamping means against the pushing direction of the piston and around the perpendicular axles (H4), said countersurfaces forming the front portion of the piston (H1), said front portion narrowing in a V- shape in the pushing direction in order to turn the clamping surfaces (H12) of the clamping members (H5) outwards towards the clamping countersurfaces (H11) positioned on the frame of the clamping means (H3).

2. An apparatus according to claim 1, **characterised** in that the axles (H4) of the clamping members (H5) are located before the front portion of the piston (H1), which tapers into a V-shape in the pushing direction.

3. An apparatus according to claim 1 or 2, **characterised** in that the piston (H1) comprises a rear portion tapering into a V-shape in the pulling direction, said rear portion being positioned against the countersurfaces (H8) of the clamping members (H5), said countersurfaces approaching the pushing axle in the pulling direction in order to turn the clamping members away from the clamping position.

4. An apparatus according to any of the preceding claims, **characterised** in that the clamping surfaces (H12) of the clamping members (H5) have a curved shape

perpendicular to the cross-section against the pushing direction and that the clamping countersurfaces (H11) opposite them on the frame (H3) have a curved shape in the same cross-section.

5. An apparatus according to any of the preceding claims, **characterised** in that between the clamping members (H5) and the frame of the clamping means (H3) is placed a balancing ring (H9), which restricts the clamping space between the clamping member (H5) and the frame (H3) at the back.

6. An apparatus according to claim 5, **characterised** in that the balancing ring (H9) is of plastic material.

7. An apparatus according to any of the preceding claims, **characterised** in that at the extreme position of the pushing motion of the piston, the clamping surfaces (H12) together with the clamping countersurfaces (H11) form an angle opening against the pushing direction.

8. An apparatus according to any of the preceding claims, **characterised** in that the clamping surfaces of the clamping means are unheated.

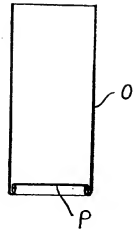

Fig. 1

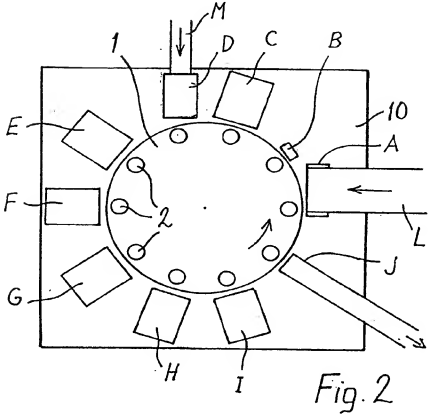

Fig. 2

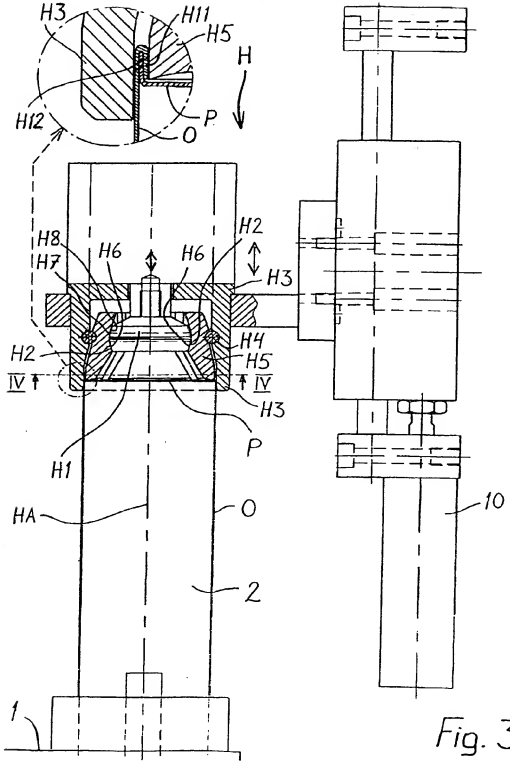

Fig. 3

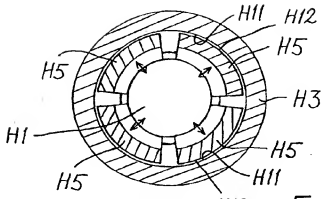

Fig. 4

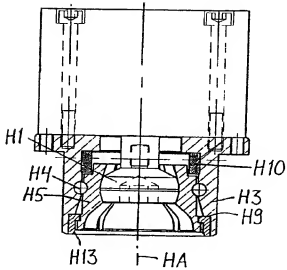

Fig. 5

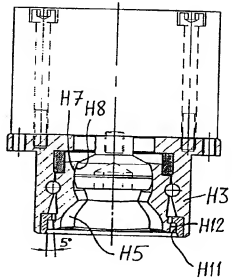

Fig. 6

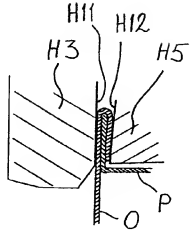

Fig. 7

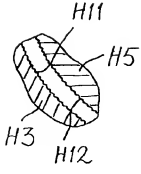

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00403

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B31B 1/30, B31B 17/30 // B31B 1/28
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B31B, B65B, B29C, B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

JAPIO, EDOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3668824 A (SOLOMONOV ET AL), 13 June 1972 (13.06.72), see especially the upper half circle of detail 11	1-8
X	GB 374301 A (CONTINENTAL CAN COMPANY, INC.), 9 June 1932 (09.06.32), see especially the opposite surfaces of the details 42 and 111	1,4-8
A	GB 2103538 A (UNILEVER PLC), 23 February 1983 (23.02.83), see the movable mandrels and the stations S10-S14	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
12 November 1999	18 -11- 1999
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Gunilla Jonsson / JA A Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00403

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DE 413236 C (ANGELO PICCALUGA), 4 May 1925 (04.05.25), see claim 2 and figure 2	1-3
A	US 5035106 A (HAASE), 30 July 1991 (30.07.91), see the recesses 82 and 124	4
A	WO 9631406 A1 (GRABHER, WERNER), 10 October 1996 (10.10.96), see especially page 7, lines 1-7 and detail 17	5-6

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/11/99

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